Thermostatic Circulation Control for Hot Water Stores using External Heat Exchanger for recovery.

Unique Principle: In a situation where you are heating stored hot water (1) by means of a plate heat exchanger (2), with heat fed from a remote boiler (4), it is desirable to regulate the rate that stored water is circulated through the heat exchanger in order to generate hot water at a set temperature. This patent covers the use of a three port thermostatic blending valve (7) in series with the plate heat exchanger, where both the valve inlet ports (8,9) are connected to the hot output from the heat exchanger, and the hot inlet port (9) is fed via a restriction (11) in order to reduce flow rates when the valve draws from the hot port (9).

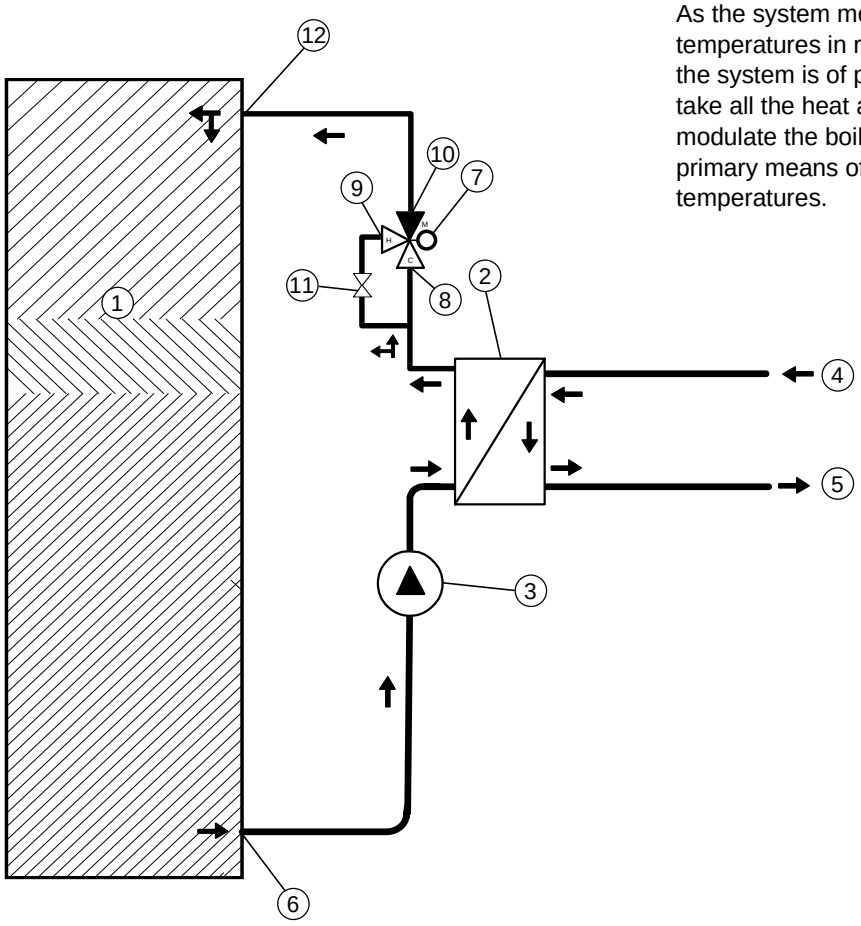
Cold water is circulated from the water storage unit (1) via a connection near the bottom (6) by means of a circulating pump (3). The pump circulates this cold water through a plate heat exchanger (2), where it is heated by conduction through metal plates from hot water circulated from a boiler (4). The boiler water gives up its heat to the storage water, before exiting the heat exchanger and returning to the boiler having been cooled (5). The heated stoerd water passes through the thermostatic mixing valve and finally reenters the store near the top (12).

Given a fixed flow rate and temperature of water fed from the boiler, the temperature to which the stored water is heated in one pass through the heat exchanger is relative to its initial cold temperature, as well as the rate of circulation. The faster the stored water flows through the heat exchanger the cooler it becomes, while at very low flow rates the water temperature approaches that of the boiler hot feed.

In a typical situation, cold stored water will be at 15c, with a target hot temperature of 60c and a maximum of 65c. The water fed from the boiler can be as high as 90c. The achievable rate of circulation needs to be capable of keeping circulation rates high enough to prevent gerenated temperatures from approaching the elaveted boiler temperatures. Typically a temperature sensor of thermostat will determine when the system has reached its limit and shut down, or limit, the feed from the boiler.

If the temperature of the heated water is below the set temperature on the thermostatic mixing valve, the valve will pull from its hot port more. As the feed to this port is restricted, the flow rate drops, and as a result the temperature of the generated water increases. As the generated temperatures increase due to the water entering the heat exchanger from the store increasing, they will rise above the set temperature on the thermostatic mixing valve. The valve will in turn start to pull more from its cold port, and as the cold port is unrestricted the flow rates will increase and the generated temperatures will drop. The valve modulates to achieve the flow that results in the set temperature been achieved.

The level to which the hot port is restricted depends on the minimum input from the boiler. Flow will not want to be too low as it will increase the response rate of the system. Neither does it want to be too high, as the flow will not be able to reduce enough to match low boiler input.



As the system modulates to achieve the correct hot water temperatures in response to the heat available from the boiler, the system is of particular advantage when it is desirabe to take all the heat available from the boiler - rather than modulate the boiler input (flow and/or temperature) as the primary means of controlling generated hot water temperatures.

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